

CLAIMS:

1. Ventilator (1) for supplying breathable gas to a patient, comprising:
 - 5 - an external housing (4);
 - an internal housing (6) suspended within said external housing (4);
 - a gas flow generator (10) located within said internal housing (6) for creating a gas flow to the patient;
 - a gas inlet conduit (22) extending between a first gas inlet opening (24) in said external housing (4) and a second gas inlet opening (26) in said internal housing (6), and
 - a gas outlet conduit (30) extending from a first gas outlet opening (32) in the internal housing (6) via a second gas outlet opening (34) in the external housing (4) and to a patient interface means (36) adapted for introducing the breathable gas into
 - 15 the airway of said patient, **characterized in** that one or both of the gas inlet conduit (22) and the gas outlet conduit (30) exhibits:
 - a first substantially rigid conduit section (40), and
 - a second membrane conduit section (42) having at least one flexible membrane wall portion (44), said membrane wall portion (44) separating a volume (v) of breathable gas within the gas inlet conduit (22) and/or gas outlet conduit (30) from a volume (V) of ambient air within the external housing (4), whilst allowing acoustic energy transfer between said volumes (v, V).
2. Ventilator (1) according to claim 1, **characterized in** that said membrane conduit section (42) is formed as a chamber (46), said chamber (46) comprising a structural frame element (48) which delimits said at least one flexible membrane wall portion (44).
- 25 3. Ventilator (1) according to claim 2, **characterized in** that said chamber (46) is arranged on an exterior face (52) of the internal housing (6), said exterior face (52) defining an inner wall section of the chamber (46).
- 30 4. Ventilator (1) according to claim 3, **characterized in** that a sound absorbent layer (not shown) is provided within said chamber (46) on said exterior face 52.
- 35 5. Ventilator (1) according to claim 2-4, **characterized in** that said structural frame element (48) comprises a grid (54) with multiple grid apertures (56), said flexible membrane wall portion (44) being formed by a single membrane sheet (44b) which

is attached to the grid (54) at least along an outer periphery (55) of the structural frame element (48) and covers said multiple grid apertures (56).

6. Ventilator (1) according to claim 5, **characterized in** that said grid apertures 5 (56) are substantially rectangular.

7. Ventilator (1) according to any of the preceding claims, **characterized in** that said chamber (46) is provided with a plurality of sound deflection barriers (64) located between an entrance opening (49) to the chamber (46) and second inlet 10 opening (26) to the internal housing (6), said sound deflection barriers (64) being arranged so as to at least partially block direct sound propagation between said entrance opening (49) and said second inlet opening (26).

8. Ventilator (1) according to any of the preceding claims, **characterized in** that a 15 flexible vibration-isolating conduit section (41) is arranged between the rigid conduit section (22) and the membrane conduit section (42).

9. Ventilator (1) according to claim 1, **characterized in** that said membrane conduit 20 section (42) is formed as a flexible tube section having a generally polyhedral cross-section, said flexible membrane wall portion (44) being defined by the wall of said tube section.

10. Ventilator (1) according to claim 9, **characterized in** that said flexible tube 25 section is made of silicone rubber.

11. Ventilator (1) according to any of the preceding claims, **characterized in** that said first substantially rigid conduit section (40) extends along the outline periphery of the external housing (4).

30 12. Ventilator (1) according to claim 11, **characterized in** that the rigid conduit section (40) is substantially L-shaped.

13. Ventilator (1) according to claims 11 or 12, wherein the external housing is manufactured by molding, **characterized in** that the rigid conduit section (40) is integrally formed with the external housing (4), and extends along the inside of an outer wall (45) of said external housing (4).

5

14. Ventilator (1) according to claim 13, **characterized in** that the rigid conduit section (40) is partially integrated in a hollow lift handle portion (25) formed in the external housing (4), the first gas inlet opening (24) being located in said lift handle portion (25).

10

15. Ventilator (1) according to any of the preceding claims, **characterized in** that said internal housing (6) is suspended in said external housing (4) by means of one or more vibration isolator elements (8).

15

16. Ventilator (1) according to any of the preceding claims, **characterized in:**

- that said gas flow generator (10) is located in a sub housing (16) within the internal housing (6), and
- that a tortuous path (74), provided with a sound absorbing lining (76), is defined between the Internal housing (6) and said sub housing (16), said tortuous path (74) extending between the second gas inlet opening (26) in the internal housing (6) and a third gas inlet opening (78) in the sub housing (16).

20

17. Ventilator (1) according to claim 16, **characterized in** that said tortuous path (74) is formed by successively arranged, and mutually displaced projecting barrier walls (80), wherein said sound absorbing lining (76) is formed as at least one undulating plastic foam insert (82) provided with slots (84) for receiving said barrier walls (80).

25

18. Ventilator (1) according any of claims 1 to 15, **characterized in:**

30

- that said gas flow generator (10) is located in a sub housing (16) within the internal housing (6), and
- that a tortuous path (74), provided with successively arranged sound absorbing elements (86), is defined between the internal housing (6) and said sub housing (16),

35

- said sound absorbing elements (86) being constituted by perforated metal plates (88) coated with sound absorbing material (90) on one or both sides thereof, said metal plates (88) being of a uniform size and shape, and angled relative to a general direction of the tortuous path (74), and

- said tortuous path (74) extending between the second gas inlet opening (26) in the internal housing (6) and a third gas Inlet opening (78) in the sub housing (16).

5 19. Ventilator (1) according to any of the preceding claims, **characterized in that**
said membrane wall portion (44) is made of a thin plastic film.

20. Noise reduction method for a ventilator (1) for supplying breathable gas to a patient, the ventilator (1) comprising:

- an external housing (4);

10 - an internal housing (6) suspended within said external housing (4);

- a gas flow generator (10) located within said internal housing (6) for creating a gas flow to the patient;

- a gas inlet conduit (22) extending between a first gas inlet opening (24) in said external housing (6) and a second gas inlet opening (26) in said internal housing (6),

15 and

- a gas outlet conduit (30) extending from a first gas outlet opening (32) in the internal housing (6) via a second gas outlet opening (34) in the external housing (4) and to a patient interface means (36) adapted for introducing the breathable gas into the airway of said patient, **characterized in that**

20 - a volume (v) of breathable gas within the gas inlet conduit (22) and/or gas outlet conduit (30) is separated from a volume (V) of ambient air within the external housing (4), whilst allowing acoustic energy transfer between said volumes (v, V) by means of one or both of the gas inlet conduit (22) and the gas outlet conduit (30) exhibiting:

25 - a first substantially rigid conduit section (40), and

- a second membrane conduit section (42) having at least one flexible membrane wall portion (44), said membrane wall portion (44) allowing said acoustic energy transfer between said volumes (v, V).